Advances in Accounting 44 (2019) 22–28

Contents lists available at ScienceDirect

Advances in Accounting

journal homepage: www.elsevier.com/locate/adiac

Unobservable transfer price exceeds marginal cost when the manager is evaluated using a balanced scorecard

Jumpei Hamamura*

Faculty of Business Administration, St. Andrew's University, Japan

ARTICLE INFO

Keywords:
Strategic transfer pricing
Observability
Balanced scorecard
Price competition
Noncooperative game theory

ABSTRACT

This study investigates the optimal level of transfer prices chosen by managers in a divisionalized firm when they are evaluated based on a balanced scorecard. A unique assumption of our model is that transfer prices are unobservable to a competing firm's managers. In contrast to the findings in several studies that examine strategic transfer pricing, this research shows that a manager who is evaluated using a balanced scorecard chooses a transfer price that exceeds marginal cost given a market competitor in a specific economic environment. This result is caused mainly by our model's assumption that a manager considers the competitor's profit in his/her in decision-making when the objective is to maximize long-term profit. This study makes a significant contribution to the strategic transfer pricing literature by showing that even if the transfer price is unobservable to rivals, the optimal transfer price exceeds marginal cost when the final product market is characterized by price competition, something not shown in previous analytical accounting research.

1. Introduction

Transfer prices have become a critically important issue for multidivisional firms. For example, General Motors and Panasonic use effective transfer prices to optimize their divisional operations and profits based on the principle that transfer prices allow managers to evaluate a manufacturing division's performance as a profit center.

While multidivisional firms attempt to effectively and accurately evaluate divisional performance using transfer pricing, it is often difficult to determine the optimal transfer price in a firm composed of multiple divisions. Because firms are generally interested in determining the optimal transfer price in a specific economic environment, transfer pricing is a practical and important issue in contemporary management accounting. Further, methods of optimal transfer pricing have been explored and proposed in empirical research from a management accounting perspective because selecting the optimal transfer price can improve a firm's profit (e.g., Chan & Lo, 2004; Tang, 1992).

Economic analysis of transfer pricing from a managerial viewpoint dates back to Hirshleifer (1956), who advocates that an internal transfer price equal to marginal cost alleviates any attendant double marginalization problem. Since Hirshleifer's (1956) work, other management accounting studies have analyzed optimal transfer prices using market competition models (e.g., Alles & Datar, 1998; Arya & Mittendorf, 2007; Autrey & Bova, 2012; Fjell & Foros, 2008; Gox, 2000; Hamamura, 2018; Matsui, 2011, 2012, 2013; Narayanan & Smith, 2000; Schjelderup & Sørgard, 1997; Shor & Chen, 2009). Most studies in this research stream examine which cost-based transfer price, other than marginal cost, is desirable for a firm (e.g., Alles & Datar, 1998; Matsui, 2011, 2013). Tang (1992) provides important empirical evidence on transfer pricing practices, specifically the relationship between transfer prices and the use of a cost accounting system. Tang (1992) describes only a few situations where firms choose marginal cost to set transfer prices, which is unlike the theoretical insight gained in Hirshleifer (1956).

Alles and Datar (1998) consider the optimal transfer price for a divisionalized firm facing price competition, showing that the optimal cost-based transfer price is above marginal cost. They explain that a firm uses an observable transfer price that exceeds marginal cost as an announcement and commitment device that encourages softer competition in a product market.[1] Hence, the firm uses a transfer price above marginal cost as a collusion device in a competitive market, aiming to obtain higher profit by choosing a higher market price. This result is based on an important assumption about the observability of competitors' internal transfer prices. Indeed, Alles and Datar (1998) assume that the transfer prices chosen by firms are observable by competitors.

* Corresponding author at: 1-1, Manabino, Izumi-city, Osaka 594-1198, Japan.
E-mail address: jmhama@andrew.ac.jp.

[1] Because of strategic complementarity in price competition, firms can engage in softer competition in a product market by choosing a transfer price above marginal cost as a commitment device.

https://doi.org/10.1016/j.adiac.2018.12.001
Received 2 April 2018; Received in revised form 11 October 2018; Accepted 11 December 2018
Available online 28 December 2018

However, given management accounting practices, this assumption is unlikely to be satisfied. A firm generally has no incentive to disclose its internal transfer price because the price reflects cost information about a sales division's cost, which is proprietary firm information. When internal transfer prices cannot be observed by outsiders, it is difficult to commit to softer price competition in the market. Hence, the transfer price cannot be above marginal cost in a competitive market because firms would lose the incentive to choose a higher transfer price.

Several studies of strategic transfer pricing relax the assumption of observability to explore optimal transfer prices in a competitive market environment (e.g., Dürr & Göx, 2011; Göx, 2000; Göx & Schöndube, 2004; Narayanan & Smith, 2000). For example, Göx (2000) shows that the optimal transfer price exceeds marginal cost when a firm uses absorption costing and the transfer price is unobservable to those outside the firm. Further, the results indicate that, unlike observable transfer prices, this does not work as a commitment device to influence a rival's behavior. Göx and Schöndube (2004) show that the optimal transfer price exceeds marginal cost when there is an agency problem caused by information asymmetry between divisions. Narayanan and Smith (2000) find that the optimal transfer price exceeds marginal cost when firms that face divisional tax differences use transfer prices as a tax avoidance device. Unlike these previous studies, our model assumes the internal transfer price is unobservable by the competitor firm and the optimal transfer price exceeds marginal cost under price competition.

Following seminal work on strategic transfer pricing (Alles & Datar, 1998), many transfer pricing studies assume the presence of market competition and examine the optimal level of internal transfer prices. In addition, previous strategic transfer pricing studies assume that the manager of a divisionalized firm, whom we label throughout this paper as the CEO, uses internal transfer prices to maximize the firm's own profit, because CEOs in a realistic environment generally consider only their own firm's profit. However, when CEOs need to consider their firms' corporate social responsibility (CSR), they may make different decisions in their product market and in the management of their firms (Karim, Lee, & Suh, 2017). Hence, the unique feature of our model is the consideration of CEOs' concerns about factors other than their own firm profits—an approach that has not been previously considered in the strategic transfer pricing literature.

Previous studies assuming a CEO objective function that includes a competitor's profit but not his/her own firm's profit, consider the CEO's decision-making in a product market (e.g., Aggarwal & Samwick, 1999; Fumas, 1992; Hino & Zennyo, 2017; Matsumura, Matsushima, & Cato, 2013; Matsumura & Ogawa, 2014). Hino and Zennyo (2017) assume that managers consider both a competitor's profit and a consumer surplus when they choose a product market strategy. Hino and Zennyo (2017) interpret the concern of a firm's manager about a competitor's profit and consumer surplus as the firm's CSR, and show that when managers take CSR into account, the decision made when another firm's profit is considered is different from the decision made when only the firm's own profit is considered. In practice, many firms increasingly pay attention to CSR and some have begun issuing CSR reports. Emphasizing CSR is a long-term strategy for firms because it helps maximize long-term profit through market growth that results from stakeholder recognition (Freeman, 1984).

Aggarwal and Samwick (1999) and Fumas (1992) analyze the different objective functions of CEOs in a competitive product market. They assume that CEOs who are evaluated by shareholders/owners based on a competitor's profit consider a competitor's profit when they develop a product market strategy, and interpret a CEO's concern about a competitor's profit as a relative performance evaluation of the CEO. For example, when a firm's profit is higher than the competitor's profit, the CEO's performance is more highly evaluated. Numerous studies discuss how relative performance evaluations are used in real-life management cases (e.g., Antle & Smith, 1986; Joh, 1999; Matsumura & Shin, 2006; Murphy, 1999).

The discussion above suggests that many studies assume CEOs consider a competitor's profit when developing a product market strategy. Hence, the present study assumes that CEOs are concerned about a competitor's profit and analyzes the optimal level of an internal unobservable transfer price when they engage in price competition in a product market. We also consider the situation in which the CEO is concerned about their own firm's profit, consistent with many studies in management accounting.

This study interprets a CEO's consideration of a competitor's profit as a type of performance evaluation based on a balanced scorecard (BSC). Performance evaluation with a BSC induces a CEO to pursue long-term profit and avoid myopic behavior. From the perspective of emphasizing long-term profit through market growth, a CEO's concern about a competitor's profit may correspond to a BSC. In management accounting practice, a BSC views long-term profit as the prevailing measure for a performance evaluation and reward system.[2] For example, by implementing a BSC in 1995, Exxon Mobil Corporation improved medium- and long-term profit (Kariozen, 2011).

Based on this discussion, we make two important assumptions in our model: (i) transfer prices are unobservable to competitors and (ii) by using a BSC, a CEO's performance evaluation incorporates the competitor's profit into their objective function. This study's model is based on these assumptions and shows that the unobservable transfer price chosen by CEOs exceeds marginal cost when CEOs consider their competitor's profit in specific economic environments. Fundamentally, because the objective function in our model includes another firm's profit as well as own-firm profit, the CEO's utility increases as the competitor's profit rises when the firm faces market price competition, as shown by Aggarwal and Samwick (1999). Hence, CEOs have an incentive to increase their competitor's profit as well as their own firm profit in this setting. Therefore, under price competition, a performance evaluation using a BSC moderates a CEO's incentive to exceed his/her competitor's profit by choosing a lower retail price than that of their competitor in the product market. In a divisionalized firm, the CEO controls the downstream division's (DD) choice of a higher market price by setting a higher transfer price.

This study makes two important contributions to the literature on strategic transfer pricing research. First, we demonstrate that the transfer price chosen by a firm exceeds its marginal cost under specific conditions of price competition even when the price is unobservable to other rivals outside of the firm. Previous strategic transfer pricing research shows that the optimal transfer price is equal to marginal cost in a general environment (e.g., Hirshleifer, 1956). This study demonstrates that the optimal unobservable transfer price is above marginal cost even when there is no agency problem, as considered in Göx and Schöndube (2004), when a cost accounting system is not used (Göx, 2000), or under tax avoidance. Second, this study explores the optimal transfer price chosen by CEOs, particularly when a BSC is adopted to evaluate their performance, an important management accounting topic that has not been examined in previous strategic transfer pricing research.

The remainder of the paper is organized as follows. Section 2 describes our basic model. Section 3 presents the equilibrium derived from the model results and Section 4 discusses the results in detail. Section 5 concludes.

2. Model

This section proposes an analytical model that describes transfer pricing in divisionalized firms. Assume that there are two firms, firm 1 and firm 2, in an industry that engages in price competition selling differentiated products in a market. There are two divisions in each firm: the upstream division (UD) and the DD. The UD produces

[2] In the management accounting literature, Kaplan and Norton (1992) originally propose a BSC as a tool for long-term firm growth.

Table 1
Notations.

π	Profit for the downstream division in a firm
Π	Total profit for a firm
O	Objective function for the CEO
i	Subscript that indexes a firm
j	Subscript that indexes a firm different from firm i
α	Weight placed on a competitor's profit, stipulated in a BSC
p	Retail price
q	Quantity
c	Marginal cost of the upstream division
t	Transfer price
a	Positive constant greater than c
θ	Substitutability of products supplied by the two firms ($0 < \theta < 1$) ($1 - \theta$ is the degree of product differentiation)

intermediate goods at marginal cost c and the DD sells them in the final goods market at price p. Without loss of generality, this study normalizes marginal cost, c, to zero for simplicity, following the multinational transfer pricing research of Autrey and Bova (2012). The DD adds value to the intermediate goods before selling them in the final goods market. Without loss of generality, this study normalizes both this value and the cost of adding value to zero. Table 1 provides the necessary notations.

The payoff functions of firm i (= 1, 2)'s DD (π_i^{DD}) and UD (π_i^{UD}) are as follows:

$$\pi_i^{DD} = (p_i - t_i)q_i, \tag{1}$$

$$\pi_i^{UD} = t_i q_i, \tag{2}$$

where p_i denotes the market price, t_i denotes the transfer price, and q_i denotes the quantity of product for firm i. Transfer prices are unobservable to the competitor and $t_i \geq 0$ is assumed. Consistent with previous work, the DD's manager is assumed to be evaluated based on the DD's own profit, which is calculated using an internal transfer price[3] (e.g., Alles & Datar, 1998; Göx, 2000; Narayanan & Smith, 2000). Hence, through setting an internal transfer price, the CEO can indirectly control the market price chosen by the DD's manager through manipulation of the sales cost of the DD using an internal unobservable transfer price. While the transfer price does not have a strategic effect, when the internal transfer price is unobservable, tacit collusion may be raised by the CEO's control of the market price.

The total profit function of firm i (Π_i) is stated as follows:

$$\begin{aligned}\Pi_i &= \pi_i^{DD} + \pi_i^{UD},\\ &= (p_i - t_i)q_i + t_i q_i,\\ &= p_i q_i.\end{aligned} \tag{3}$$

Using this joint profit function, the firm's shareholders/owners evaluate the CEO's performance using a BSC. Following the formulation of models in previous research, the objective function for a CEO whose performance is evaluated using a BSC, O_i, is expressed as follows:

$$O_i = \Pi_i + \alpha_i \Pi_j, \tag{4}$$

where $\alpha_i \geq 0$ is the weight placed on the competitor's profit in a BSC. Hereafter, (i, j) represents either (1, 2) or (2, 1). A positive value for α_i is expected for CEO i to commit to softer competition because the CEO is evaluated according to increases in the competitor's profit.

We assume that the firm adopts a BSC for performance evaluation of the CEO when $\alpha_i > 0$. When α_i has a positive value, the CEO of the firm considers the competitor's profit to maximize his/her own performance. In other words, the firm's CEO is not only concerned with own-firm profit, but also the long-term growth of the product market. It is argued that a BSC is an effective tool for emphasizing the importance of long-term profit for CEOs in practice (Kaplan & Norton, 1992) and this study interprets $\alpha_i > 0$, which emphasizes long-term market growth, as a BSC. This assumption holds in reality because we derive a positive α_i in our equilibrium results.

Consequently, we rewrite Eq. (4) as follows:

$$\begin{aligned}O_i &= \Pi_i + \alpha_i \Pi_j\\ &= p_i q_i + \alpha_i p_j q_j.\end{aligned} \tag{5}$$

Firm i's CEO chooses transfer price t_i to maximize the objective function in Eq. (5).

An inverse demand function is used in this investigation. Consider the following indirect utility function of a representative consumer:

$$u(q_1, q_2, p_1, p_2) = a(q_1 + q_2) - \frac{1}{2}((q_1)^2 + (q_2)^2 + 2\theta q_1 q_2) - p_1 q_1 - p_2 q_2. \tag{6}$$

This utility function is used because it is a well-known function in industrial organization research. By solving the first-order condition of maximizing Eq. (6) with respect to q_1 and q_2, firm i faces the following demand function:

$$p_i = a - q_i - \theta q_j, \quad (i,j) = (1,2), (2,1). \tag{7}$$

where a is a positive constant greater than c and $\theta \in (0, 1)$ is interpreted as the degree of substitution between products. As θ approaches 0, the market becomes a monopoly by a firm i. Hereafter, (i,j) represents $(1,2)$ or $(2,1)$, when two valuables simultaneously appear in one equation. Simultaneously, solving Eq. (7) gives each demand quantity as a function of price:

$$q_i = \frac{((1-\theta)a - p_i + \theta p_j)}{(1-\theta)(1+\theta)} \tag{8}$$

The timeline of events proceeds as follows. At date 1, the CEO and shareholders/owners of a firm sign a contract that stipulates the use of a BSC to evaluate the CEO's performance. The transfer price, which is decided by the CEO in the second step, cannot be observed by the competitor's DD. However, the same firm's DD can observe its own firm's transfer price. Next, the DDs of each firm choose market price p. Finally, profits are realized and compensation is paid to the CEO at Date 4. The timeline of events is presented in Fig. 1.

3. Analysis

In this section, the subgame perfect Nash equilibrium is derived using backward induction. All proofs are provided in the Appendix. Firm i's optimal strategies in equilibrium are determined when the weight placed on the competitor's profit, α (> 0), is given. As assumed, the internal transfer price chosen by the competitor is unobservable to the firm. Firm i chooses the following transfer price and market price.

Proposition 1. *When the positive weight placed on the competitor's profit, α_i, is exogenously given, firm i chooses the following transfer price, $\hat{t}_i$, and market price, $\hat{p}_i$:*

$$\hat{t}_i = \frac{\theta(1-\theta)((4+\theta(1-2\theta)+\theta(2-\theta)\alpha_j)\alpha_i - 2(1-\theta)\alpha_j)a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)},$$

$$\hat{p}_i = \frac{(1-\theta)(2(1+2\theta)(3-2\theta)+\theta(5-\theta-2\theta^2)\alpha_i+\theta(1-\theta)(2+\theta\alpha_i)\alpha_j)a}{2(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)}.$$

Proposition 1 suggests that the equilibrium transfer price of $\hat{t}_i$ chosen by the CEO of firm i, is subject to the weight each firm placed on the competitor's profit, α_i and α_j. This outcome is caused by the use of a

[3] Vroom (2006) previously considered downstream division performance evaluation systems that are developed by the CEO. However, prior strategic transfer pricing research does not consider these performance evaluation systems and simply analyzes CEO performance evaluation systems under price competition.

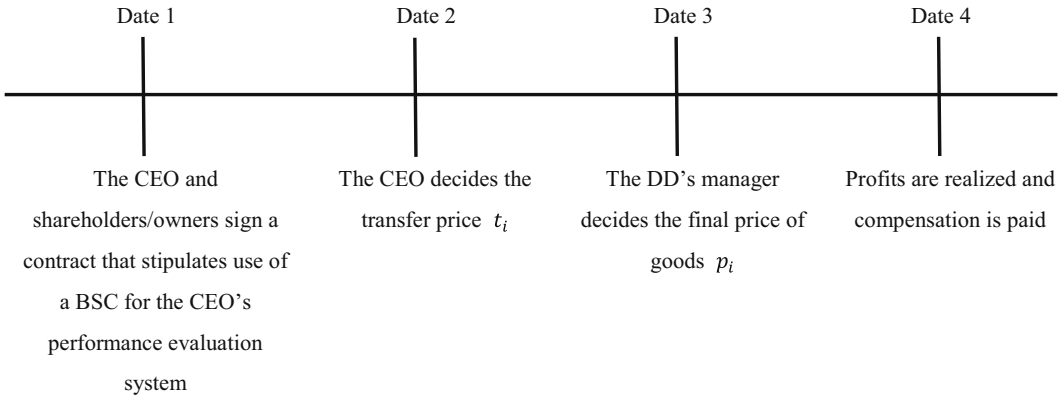

Fig. 1. Timeline of events.

BSC, which forces the CEO to display specific behavior, indirectly controlling the DD's market price through internal transfer pricing. The market price is also affected by the unobservable transfer price and choice of weight placed on the competitor's profit.

In addition, when the competitor does not adopt a BSC, the firm chooses the following internal transfer pricing.

Proposition 2. *When the competitor does not adopt a BSC so that* $\alpha_j = 0$ *holds, firm i chooses the following transfer price* $\hat{t}_i(\alpha_i, 0)$:

$$\hat{t}_i(\alpha_i 0) = \frac{\theta(1-\theta)(4+\theta(1-2\theta))\alpha_i a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_i)}.$$

Proposition 2 suggests that the transfer price is not equal to marginal cost even if the competitor does not use a BSC. Because the firm's performance evaluation system affects the CEO's transfer pricing decision in our model, CEOs aim to improve their performance by manipulating the market price chosen by the DD to boost the competitor's profit. They accomplish this using the transfer price because the competitor's profit is included in the CEO's objective function when the BSC is adopted for performance evaluation. The manager's performance is measured by referring to the competitor's profit when the firm adopts a BSC. Hence, the firm's adoption of a BSC system leads to this result even though the competitor adopts a BSC.

Next, we compare the transfer price with marginal cost.

Corollary 1. $\hat{t}_i(\alpha_i 0)$ exceeds marginal cost for all parameters, when $0 < \alpha_i \leq 1$ holds.

Corollary 1 suggests that the transfer price exceeds marginal cost only when the firm adopts a BSC and the weight placed on the competitor's profit for the performance evaluation is positive. Hence, this study finds that the CEO chooses a transfer price above marginal cost when he/she is evaluated based on a BSC even though the competitor's transfer price used in the competing frim is unobservable. Under price competition, this outcome is caused by the incentive to commit to softer competition when the CEO is concerned about the competitor's profit.[4] Therefore, the CEO induces the DD to choose a higher market price by using a transfer price above marginal cost.

Proposition 2 shows that the unobservable transfer price exceeds marginal cost when the firm adopts a BSC, and Corollary 1 shows that the unobservable transfer price exceeds marginal cost when the weight placed on the competitor's profit, α_i, is positive. If the firm anticipates that the competitor will choose a transfer price above marginal cost, the firm commits to softer competition by choosing a higher internal unobservable transfer price. Hence, this result is caused by the incentive to commit to softer price competition by considering the competitor's profit in a BSC.

We next examine the property of the optimal internal transfer price when both firms adopt a BSC. We obtain the following proposition.

Proposition 3. $\hat{t}_i$ exceeds marginal cost, when $0 < \alpha_i \leq 1$ holds.

Proposition 3 holds for the same reason shown in Corollary 1. Both CEOs have an incentive to engage in softer price competition in the market. In particular, when both firms adopt a BSC, they choose a high internal transfer price, which exceeds marginal cost because of the softer price competition. Although it is not clear whether the firm chooses a BSC, this result is interesting and significant because of the transfer price above marginal cost under price competition.

Next, we consider whether the transfer price depends on α_i.

Proposition 4. Differentiation of $\hat{t}_i$ with respect to the weight placed on the competitor's profit α_i yields the following:

$$\frac{\partial \hat{t}_i}{\partial \alpha_i} = \frac{\theta^2(1-\theta)(3-2\theta)(1+2\theta+\theta\alpha_j)(4-\theta(1-2\theta)+\theta^2\alpha_j)a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)^2}.$$

Because this value is positive for all parameter values, the transfer price, $\hat{t}_i$, is increased by increasing α_i.

Proposition 4 shows that when the exogenously given competitor's weight placed on the firm's profit α_j and degree of product differentiation θ are fixed, the firm's transfer price changes when the weight placed by the firm on the competitor's profit, α_i, is altered. It is intuitive that the unobservable transfer price, $\hat{t}_i$, increases when α_i is increased, because firm i raises the marginal cost of the DD to emphasize the competitor's profit as α_i increases. The CEO emphasizes the competitor's profit by increasing α_i. Hence, he/she loses the incentive to engage in intense price competition, inducing the DD to choose a higher market price by setting a higher internal transfer price to engage in softer market competition.

The following analysis shows the effect of altering α_j on the equilibrium transfer price. We thus obtain the following proposition.

Proposition 5. Differentiation of $\hat{t}_i$ with respect to α_j yields the following:

$$\frac{\partial \hat{t}_i}{\partial \alpha_j} = -\frac{2\theta(1-\theta)(3-2\theta)(1-\theta-\theta\alpha_i)(1+2\theta+\theta\alpha_i)}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)^2}.$$

From this outcome, $\hat{t}_i$ increases by increasing α_j, when $(1-\theta)/\theta < \alpha_i$.

From Proposition 5, when θ is fixed, the firm's transfer price changes by altering the competitor's weight placed on the firm's profit, α_j. Similar to Proposition 4, it is intuitive that the unobservable transfer price, $\hat{t}_i$, increases as α_i increases for the following reason. Each firm has an incentive to set a higher retail price because of strategic

[4] This is because price competition in a product market has the effect of strategic complementarity. Strategic complementarity in price competition allows firms to boost their retail price when a competitor increases marginal cost of a product that is supplied in a market (See Bulow, Geanakoplos, & Klemperer, 1985).

complementarity as the competitor (firm j) chooses a higher market price by increasing the weight placed on the firm's profit (α_j).[5] Hence, in this situation, the firm chooses a higher transfer price to induce a higher market price by the DD.

4. Discussion

This study investigates the transfer pricing decision by a manager when the manager in a divisionalized firm is evaluated using a BSC that places a positive weight on the competitor's profit for the performance evaluation. The use of a BSC leads to equilibrium transfer price levels that are different from those when a BSC is not adopted. The positive weight placed on the competitor's profit does not lead the CEO to seek a competitive advantage by charging a lower price, because increasing the competitor's profit improves the CEO's performance. Hence, each of the CEOs loses the incentive to improve only their own profit; consequently, each CEO charges a higher cost to the DD and indirectly raises the market price by choosing a higher transfer price. However, this result occurs only when one firm's profit is considered as a factor in the other firm's CEO evaluation.

Vroom (2006) considers the problem of what weight placed on a competitor's profit to the DD manager is desirable to a firm. The current study considers the problem of what weight should be placed on a competitor's profit in the CEO's evaluation, as in Aggarwal and Samwick (1999) and Fumas (1992). Substantial previous research has investigated the performance evaluation of CEOs by shareholders/owners, including a BSC, because the issue is important when we explore a firm's desirable strategy. In contrast, other internal transfer pricing studies have not considered the CEO's performance evaluation when choosing the firm's strategy.

The present study considers the transfer price when CEO performance is evaluated using a BSC and finds that the transfer price is above marginal cost in an unobservable transfer price situation. Previous work often shows that the transfer price exceeds marginal cost when the transfer price is unobservable to the CEO in another firm. However, this study makes two main contributions to the strategic transfer pricing literature: (i) it considers the CEO's performance evaluation system (BSC) in the transfer pricing context and (ii) shows that the CEO chooses an internal transfer price above marginal cost in unobservable transfer price situations.

5. Conclusion

This study investigates the transfer price chosen by a firm's manager, i.e., the CEO, when the transfer price is unobservable to another firm and the CEO is evaluated based on a balanced scorecard (BSC) stipulating that the competing firm's profit is included in the CEO's objective function. This study shows that the equilibrium transfer price chosen by the CEO exceeds marginal cost in a specific economic environment, which has not previously been shown in the strategic transfer pricing literature. This finding is induced by the CEO's decision, which takes into account the competitor's profits when a BSC is used.

This study makes two major contributions to the strategic transfer pricing literature: (i) our model shows that the optimal internal transfer price exceeds marginal cost under price competition and (ii) it considers the CEO's performance evaluation using a BSC. The latter is an important issue in the stream of management accounting research.

This research provides important implications for management accounting practice. As the firm normally cannot observe the internal transfer prices of competitors under price competition, a manager in a firm must consider their performance evaluation system using a BSC when determining the transfer price. Additionally, when the firm's shareholders/owners cannot use a transfer price as a commitment device, they can control the CEO's behavior by committing to soft competition.

This study has some limitations. First, the endogenous choice of α is not considered because it is beyond the scope of this study. It is a natural idea that most firms decide α endogenously in practice. However, the endogenous determination of α is not consistent with our model's purpose because the transfer pricing decisions of a manager who is evaluated using a BSC is the major concern of our model. Hence, we do not analyze endogenously chosen α in this study, although this would be an important consideration in future research. Second, while the competitor's performance evaluation is not observable in management accounting practice, we assume in our model that the competitor's performance is observable. In spite of this practice, when firms are engaged in the same industry, the statistical method in Vrettos (2013) can be used to guess the competitor's performance evaluation. Hence, the assumption in our model of the observability of a competitor's performance evaluation is not impossible in practice. These issues are avenues for future research.

Conflicts of interest

The authors declare no conflicts of interest associated with this manuscript.

Acknowledgement

The author gratefully acknowledges an anonymous reviewer's insightful comments. Earlier versions of this research was presented at the 39th Annual Congress of the European Accounting Association, Maastricht, 11–13 May 2016. The author is thankful to Takami Matsuo, Kenji Matsui, and Takehisa Kajiwara for their helpful comments. Needless to say, the author is solely responsible for any remaining errors. The author also greatly appreciates Financial support of Grant-in-Aid for Young Scientists (18K12909) from the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT).

Appendix A. Appendix

Proof of Proposition 1

We derive the subgame perfect Nash equilibrium using backward induction.[6] First, we derive the retail price chosen by the DD of firm i on Date 3. By solving $\partial\pi_i/\partial p_i = 0$, the best response function of firm i is as follows:

$$BR_i^*(p_j^e) = p_i = \frac{(1-\theta)a + \theta p_j^e + t_i}{2} \tag{A1}$$

p_j^e is the market price anticipated by firm i because it cannot observe firm j's internal transfer price. In addition, firm i anticipates firms j's unobservable internal transfer price as t_j^e. Therefore, firm i anticipates firm j's best response function as follows:

[5] In this situation, firms choose strategies of the same sign in strategic complementarity; when the competitor increases p, the firm harmonizes its strategy, which increases market price.

[6] This research refers to Belleflamme and Peitz's (2010) solution for identifying the subgame perfect Nash equilibrium.

$$BR_j^*(p_i^e) = p_j^e = \frac{(1-\theta)a + \theta p_i^e + t_j^e}{2} \tag{A2}$$

Firm j anticipates that firm i anticipates Eq. ((A2) as firm j's market price. Using this reveals that firm j anticipates the following expected price:

$$p_i^e = \frac{(2+\theta)(1-\theta)a + \theta^2 p_i^e + \theta t_j^e + 2t_i^e}{4} \tag{A3}$$

Using Eq. (A3), firm j anticipates p_i^e as follows:

$$p_i^e = \frac{(2+\theta)(1-\theta)a + 2t_i^e + \theta t_j^e}{(2-\theta)(2+\theta)} \tag{A4}$$

Simultaneously, the market price of firm j anticipated by firm i is:

$$p_j^e = \frac{(2+\theta)(1-\theta)a + \theta t_i^e + 2t_j^e}{(2-\theta)(2+\theta)} \tag{A5}$$

Combining, using Eqs. (A1) and (A5), the following outcome is obtained:

$$p_i = \frac{2(2+\theta)(1-\theta)a + (2-\theta)(2+\theta)t_i + \theta t_i^e + 2t_j^e}{2(2-\theta)(2+\theta)} \tag{A6}$$

In addition, firm i anticipates firm j's market price as follows:

$$p_j^e = \frac{2(2+\theta)(1-\theta)a + 2t_i^e + (\theta + (2-\theta)(2+\theta))t_j^e}{2(2-\theta)(2+\theta)} \tag{A7}$$

Next, we consider Date 2. On this date, firm i's CEO chooses an internal transfer price to maximize the objective function, O_i, which is represented by Eq. (5). The first-order condition with respect to t_i is obtained. However, the first-order condition of firm i includes t_i, t_i^e, and t_j^e. Hence, we substitute t_i into t_i^e and reconcile the anticipation of firms to the optimal transfer pricing strategies. As a result, the analysis obtains the best response function, $BR_i^*(t_j^e) = t_i^e$. Similarly, the CEO of firm j also decides t_i^e. From these outcomes, t_i^e and p_i^e are stated as:

$$t_i^e = \frac{\theta(1-\theta)((4+\theta(1-2\theta)+\theta(2-\theta)\alpha_j)\alpha_i - 2(1-\theta)\alpha_j)a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)}, \tag{A8}$$

$$p_i^e = \frac{(1-\theta)(2(1+2\theta)(3-2\theta)+\theta(5-\theta-2\theta^2)\alpha_i+\theta(1-\theta)(2+\theta\alpha_i)\alpha_j)a}{2(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)} \tag{A9}$$

Finally, representing $t_i^e = \hat{t}_i$ and $p_i^e = \hat{p}_i$, we obtain $\hat{t}_i$ and $\hat{p}_i$..

Proof of Proposition 2

Let $\hat{t}_i(\alpha_i, 0)$ denote the transfer price when α_j is set as 0. Substituting $\alpha_j = 0$ into Eq. (A8) yields,

$$\hat{t}_i(\alpha_i, 0) = \frac{\theta(1-\theta)(4+\theta(1-2\theta))\alpha_i a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_i)} \tag{A10}$$

Proof of Corollary 1

From Proposition 2, $\hat{t}_i(\alpha_i, 0) > 0$ is obtained straightforwardly.

Proof of Proposition 3

From Proposition 2, $\hat{t}_i > 0$ is obtained straightforwardly.

Proof of Proposition 4

Differentiate $\hat{t}_i$ with respect to α_i to obtain the following:

$$\frac{\partial \hat{t}_i}{\partial \alpha_i} = \frac{\theta^2(1-\theta)(3-2\theta)(1+2\theta+\theta\alpha_j)(4-\theta(1-2\theta)+\theta^2\alpha_j)a}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)^2} \tag{A11}$$

This outcome is positive for all parameters. Therefore, $\hat{t}_i$ increases by increasing α_i.

Proof of Proposition 5

Differentiate $\hat{t}_i$ with respect to α_j to obtain the following:

$$\frac{\partial \hat{t}_i}{\partial \alpha_j} = -\frac{2\theta(1-\theta)(3-2\theta)(1-\theta-\theta\alpha_i)(1+2\theta+\theta\alpha_i)}{(2-\theta)((1+2\theta)(3-2\theta)+\theta(1-2\theta)\alpha_j+\theta(1-2\theta-\theta\alpha_j)\alpha_i)^2} \tag{A12}$$

This derivative is positive when $(1-\theta)/\theta < \alpha_i$ holds. Therefore, $\hat{t}_i$ increases as α_j increases.

References

Aggarwal, R., & Samwick, A. A. (1999). Executive compensation, strategic competition, and relative performance evaluation: Theory and evidence. *The Journal of Finance, 54*(6), 1999–2043.

Alles, M., & Datar, S. (1998). Strategic transfer pricing. *Management Science, 44*(4), 451–461.

Antle, R., & Smith, A. (1986). An empirical investigation of the relative performance evaluation of corporate executives. *Journal of Accounting Research, 24*(1), 1–39.

Arya, A., & Mittendorf, B. (2007). Interacting of supply chain distortions: The pricing of internal transfers and external procurement. *The Accounting Review, 82*(3), 551–580.

Autrey, R., & Bova, F. (2012). Gray markets and multinational transfer pricing. *The Accounting Review, 87*(2), 393–421.

Belleflamme, P., & Peitz, M. (2010). *Industrial Organization: Markets and strategies.* Cambridge University Press.

Bulow, J. I., Geanakoplos, J. D., & Klemperer, P. D. (1985). Multimarket oligopoly: Strategic substitutes and complements. *Journal of Political Economy, 93*(3), 488–511.

Chan, K. H., & Lo, A. W. (2004). The influence of management perception of environmental variables on the choice of international transfer-pricing methods. *The International Journal of Accounting, 39*(1), 93–110.

Dürr, O. M., & Göx, R. F. (2011). Strategic incentives for keeping one set of books in

international transfer pricing. *Journal of Economics and Management Strategy, 20*(1), 269–298.
Fjell, K., & Foros, Ø. (2008). Access regulation and strategic transfer pricing. *Management Accounting Research, 19*(1), 18–31.
Freeman, E. R. (1984). *Strategic Management: A Stakeholder Approach.* Pitman Publishing.
Fumas, V. S. (1992). Relative performance evaluation of management: The effects on industrial competition and risk sharing. *International Journal of Industrial Organization, 10*(3), 473–489.
Göx, R. F. (2000). Strategic transfer pricing, absorption costing, and observability. *Management Accounting Research, 11*(3), 327–348.
Göx, R. F., & Schöndube, J. R. (2004). Strategic transfer pricing with risk averse agents. *Schmalenbach Business Review, 56*(2), 98–118.
Hamamura, J. (2018). The impact of an information linkage system on a firm's organization structure, transfer price, and profit. *Asia-Pacific Management Accounting Journal, 13*(1), 141–152.
Hino, Y., & Zennyo, Y. (2017). Corporate social responsibility and strategic relationships. *International Review of Economics, 64*(3), 231–244.
Hirshleifer, J. (1956). On the economics of transfer pricing. *The Journal of Business, 29*(3), 172–184.
Joh, S. W. (1999). Strategic managerial incentive compensation in Japan: Relative performance evaluation and product market collusion. *Review of Economics and Statistics, 81*(2), 303–313.
Kaplan, R. S., & Norton, D. P. (1992). The balanced scorecard – Measures that drive performance. *Harvard Business Review, 70*(1), 71–79.
Karim, K., Lee, E., & Suh, S. (2017). Corporate social responsibility and CEO compensation structure. *Advances in Accounting, 40*, 27–41.
Kariozen, W. (2011). The influence of Balanced Scorecard implementation on the value of oil company-the case of Mobil Corporation. *Ad Alta: Journal of Interdisciplinary Research, 1*(2), 42–45.
Matsui, K. (2011). Strategic transfer pricing and social welfare under product differentiation. *European Accounting Review, 20*(3), 521–550.
Matsui, K. (2012). Auditing internal transfer prices in multinationals under monopolistic competition. *International Tax and Public Finance, 19*(6), 800–818.
Matsui, K. (2013). Entry deterrence through credible commitment to transfer pricing at direct cost. *Management Accounting Research, 24*(3), 261–275.
Matsumura, T., Matsushima, N., & Cato, S. (2013). Competitiveness and R&D competition revisited. *Economic Modelling, 31*, 541–547.
Matsumura, T., & Ogawa, A. (2014). Corporate social responsibility or payoff asymmetry? A study of an endogenous timing game. *Southern Economic Journal, 81*(2), 457–473.
Matsumura, E. M., & Shin, J. Y. (2006). An empirical analysis of an incentive plan with relative performance measures: Evidence from a postal service. *The Accounting Review, 81*(3), 533–566.
Murphy, K. J. (1999). Executive compensation. In O. Ashenfelter, & D. Card (Vol. Eds.), *Handbook of Labor Economics*. *Vol. 3B*. *Handbook of Labor Economics* (pp. 2485–2563). Amsterdam: Elsevier/North-Holland.
Narayanan, V. G., & Smith, M. (2000). Impact of competition and taxes on responsibility center organization and transfer prices. *Contemporary Accounting Research, 17*(3), 497–529.
Schjelderup, G., & Sørgard, L. (1997). Transfer pricing as a strategic device for decentralization multinationals. *International Tax and Public Finance, 4*, 277–290.
Shor, M., & Chen, H. (2009). Decentralization, transfer pricing, and tacit collusion. *Contemporary Accounting Research, 26*(2), 581–604.
Tang, R. (1992). Transfer pricing in the 1990. *Management Accounting (U.K.), 73*(8), 22–26.
Vrettos, D. (2013). Are relative performance measures in CEO incentive contracts used for risk reduction and/or for strategic interaction? *The Accounting Review, 88*(6), 2179–2212.
Vroom, G. (2006). Organizational design and the intensity of rivalry. *Management Science, 52*(11), 1689–1702.